Student Information Sheet

Community College Consortium
for
Health and Safety Training

Student Name: _____

Social Security Number: _____

Mail Address: _____

_____

_____

_____

Phone Number (_____)_____

Work Address: _____

_____

_____

_____

Work Phone Number (_____)_____

Do your job duties include: _____ emergency response to chemical releases.
_____ waste site clean-up activities.

MEDICAL QUESTIONNAIRE

NAME_____

Please fill out this questionnaire to the best of your knowledge on any and all medical conditions you have or have had for your protection. The respirators and suits do become hot, heavy, and put a strain on the cardiovascular and pulmonary systems.

If you have any medical conditions not listed on this form which may be affected by participating in these activities please notify the instructor.

If you answer yes to any of the questions please list if there are no restrictions.

YES NO 1. Do you have or have you had a heart condition (heart attack, angina, heart murmur, pacemaker, etc.)?

YES NO 2. Have you ever had rheumatic fever?

YES NO 3. Do you have or have you ever had a brain tumor, stroke, or aneurysm?

YES NO 4. Do you have claustrophobia (fear of confined space)?

YES NO 5. Do you have high blood pressure?

YES NO 6. Do you take medication for high blood pressure?

YES NO 7. Do you have any lung diseases (emphysema, one or partial lung removed, etc.)?

YES NO 8. Do you have asthma or severe allergies?

YES NO 9. Do you have a hernia?

YES NO 10. Have you suffered from heat exhaustion or heat stroke within the last two years?

YES NO 11. Are you diabetic either controlled by diet, pills, or insulin?

YES NO 12. Do you have grand or any other type of seizures (epilepsy)?

YES NO 13. Are you taking any prescribed medication for a medical condition not mentioned above?

YES NO 14. Do you wear contact lenses?

YES NO 15. Are you pregnant?

CCCHST / HMTRI Course Evaluation Form

Program/Course Title:_____

Location: _____ State _____

College: _____ Date _____

Location of you facility, organization, or department (enter the zip code)_____

Years of experience in the subject area related to the course: less than 1___ 1 to 5 ___ 6 to 10 ___ more than 10 ___

Years of formal education less than 9 ___ 9 to 12 ___ 13 to 16 ___ more than 16 ___

Your present position (check each that is appropriate)

___ Maintenance ___ Production ___ Laboratory
___ Engineering ___ Management ___ Fire Brigade
___ Spill Team ___ Security ___ Personnel/Training
___ Safety Department ___ Environmental ___ Construction
___ Municipal ___ Hazardous Waste ___ Demolition
___ Other _____

Overall this course was: ___ Excellent ___ Very Good ___ Good ___ Average ___ Poor ___ Very poor

		Not Applicable	Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree
PRINTED MATERIALS	**were well organized**	na	SD	D	U	A	SA
	were complete	na	SD	D	U	A	SA
	were readable (printed well)	na	SD	D	U	A	SA
VISUAL MATERIALS	**related to course**	na	SD	D	U	A	SA
	were of good quality	na	SD	D	U	A	SA
	were appropriate in number	na	SD	D	U	A	SA
	were easy to see	na	SD	D	U	A	SA
INSTRUCTOR	**related material to class needs**	na	SD	D	U	A	SA
	know subject	na	SD	D	U	A	SA
	encouraged participation	na	SD	D	U	A	SA
	maintained control of class activities	na	SD	D	U	A	SA
	made course expectations, requirements, & objectives clear	na	SD	D	U	A	SA
	answered questions completely	na	SD	D	U	A	SA
	used appropriate technical and professional language	na	SD	D	U	A	SA
	used course text and materials effectively	na	SD	D	U	A	SA

	tolerated differences of opinion	na	SD	D	U	A	SA
CLASSROOM	was comfortable	na	SD	D	U	A	SA
	included a manageable number of students	na	SD	D	U	A	SA
	contained a minimum number of distractions	na	SD	D	U	A	SA
EQUIP. & TRAINING AREAS	related to course	na	SD	D	U	A	SA
	were of good quality	na	SD	D	U	A	SA
	were appropriate in number	na	SD	D	U	A	SA
	were safe	na	SD	D	U	A	SA
COURSE	contained enough activities	na	SD	D	U	A	SA
	included useful activities	na	SD	D	U	A	SA
	was reasonable in length	na	SD	D	U	A	SA
	covered right amount of material	na	SD	D	U	A	SA
	was worth recommending to others	na	SD	D	U	A	SA
	contributed to my knowledge and skills	na	SD	D	U	A	SA

Please indicate concerns:

Other comments, needs or questions:

Name (optional)_____

Address_____

_____

_____

phone _____

EMERGENCY RESPONSE TO CHEMICAL SPILLS COMPETENCIES

The participant will:

1. **attend class daily,**
2. **participate in all activities,**
3. **demonstrate competency in completing selected hands-on skills with 100% accuracy,**
4. **attain a minimum score of 70% on the final written examination,**
5. **demonstrate how to implement an emergency response plan,**
6. **explain how to classify, identify, and verify the presence of known and unknown materials using field survey instruments and equipment,**
7. **function within an assigned role within the Incident Command System,**
8. **properly select and use specialized chemical protective equipment provided to the hazardous materials technician,**
9. **explain hazard and risk management,**
10. **perform advance spill containment, countermeasures, and control operations within the capabilities of the resources and personal protective equipment available to the emergency response team,**
11. **implement appropriate decontamination procedures for given situations,**
12. **use chemical terminology and toxicological terminology to communicate information.**

COMPETENCIES DEMONSTRATED

F - Fail Ö **- Attendance/Participation** **NE - Not Evaluated**

SCBA Use	_____	Corrosive Spill Neutralization	_____
Full Face Respirator Use	_____	Chemical Spill Response	_____
PPE Dress-out Exercise	_____	Chlorine Kit Application (A, B, C)	_____
Decon Exercise	_____	Drum Transfer	_____
PPE Use Leve A	_____	Drum Handling	_____
PPE Use Leve B	_____	Plug/Patch & Overpack	_____
PPE Use Leve C	_____	Use Basic Monitoring Equipment	_____
PPE Use Leve D	_____	Air-bag Deployment Exercise	_____

Comments on Back	**Day 1**	**Day 2**	**Day 3**
Attendance	**p/f**	**p/f**	**p/f**
Participation	**p/f**	**p/f**	**p/f**
Test and quizzes	**p/f**	**p/f**	**p/f**

Student Name:_____

Course Location: _____

Instructor: _____ **Date:** _____/_____/_____

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MSDS LEARNING ACTIVITY
CHEMICAL AWARENESS

Using the MSDS given to you answer the following questions.

1. Name of manufacturer and 24 hour telephone number.
2. Chemical name of substance.
3. Trade name if relevant.
4. Acute health effects:

5. Chronic health effects:

6. Physical and health hazards for this substance. Check the appropriate box.

HEALTH HAZARDS

- ❑ Carcinogen
- ❑ Irritant
- ❑ Corrosive
- ❑ Toxic
- ❑ Sensitizer

PHYSICAL HAZARDS

- ❑ Combustible liquid
- ❑ Compressed gas
- ❑ Explosive
- ❑ Flammable solid
- ❑ Flammable liquid
- ❑ Flammable gas
- ❑ Organic peroxide
- ❑ Oxidizer
- ❑ Water reactive/Unstable
- ❑ Pyrophoric

7. State of matter for the chemical. Check the appropriate box.

❑ solid ❑ liquid ❑ gas

8. What does the material look like? Check all that are appropriate.

- ❑ crystalline powder
- ❑ pellets
- ❑ clear liquid
- ❑ colored liquid
- ❑ colorless gas
- ❑ colored gas
- ❑ solid particles
- ❑ other: describe below

9. Does the chemical have an odor? ❑ YES ❑ NO

Describe odor if yes.

10. Is the chemical an eye irritant? ❑ YES ❑ NO

11. Primary route of entry for this chemical?

❑ Inhalation ❑ Eye/skin contact ❑ Ingestion

12. List the signs and symptoms of exposure.

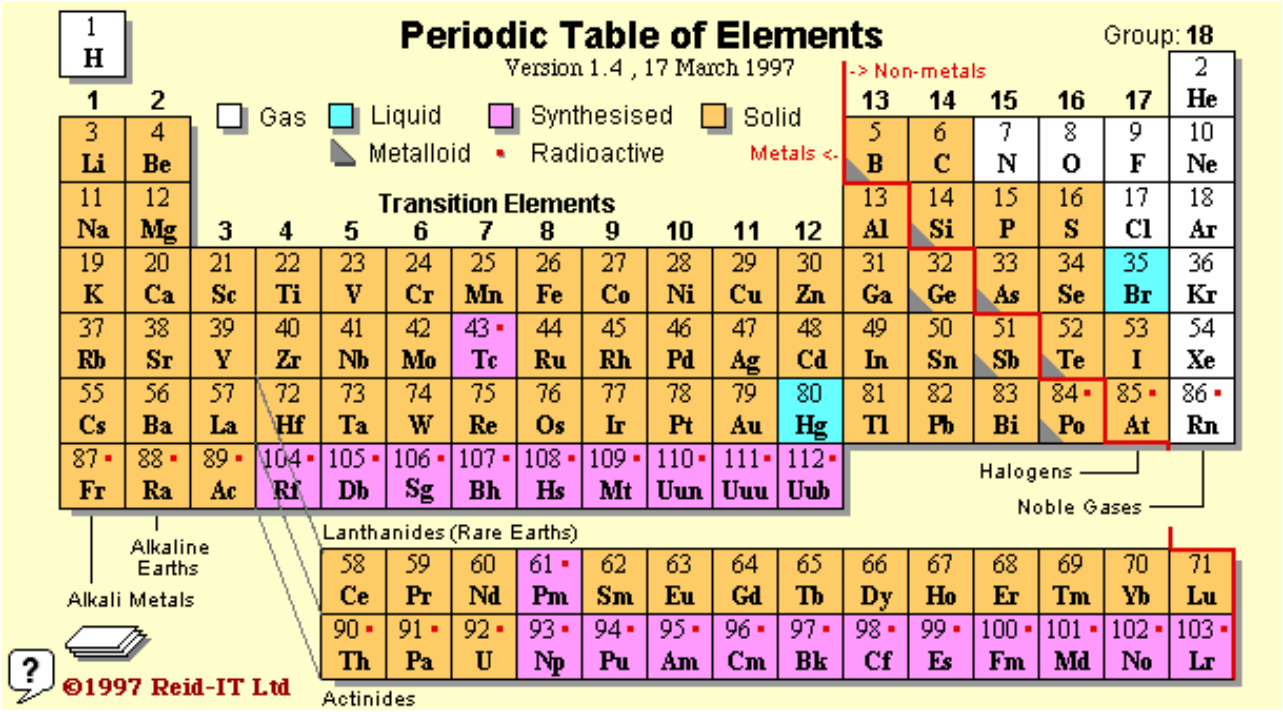
13. List the personal protective equipment required.

14. Reactivity with other materials. ❑ YES ❑ NO List if yes.

15. Can you safely handle a spill of this chemical as part of the daily routine of your job or would you need outside assistance? Explain your answer.

ACUTE HEALTH EFFECTS OF SELECTED HAZARDOUS MATERIALS

CLASS	SYMPTOMS	TREATMENT
Explosives (e.g. Nitrates, Nitroglycerin)	Headaches, hypotension, shortness of breath, arrhythmia, eye/skin irritation, methemoglobin formation, and cyanosis.	-Remove from exposure. -Decontaminate. -Support ventilation and circulation. -Consult ER and SOPs.
Flammable Liquids (Hydrocarbons, e.g. Gasoline Chloroform, Trichloroethylene)	CNS depression, dizziness, motor and sensory nerve effects. Some may cause arrhythmia, respiratory irritation progressing to pulmonary edema, or sudden death.	-Remove from exposure. -Decontaminate. -Eye, skin irrigation. -Support ventilation and circulation. Consult ER and SOPs.
Combustible Solids (e.g. Lithium Compounds)	Skin/eye/lung irritants Some have CNS effects Severe exposure may result in cardiac dysrhythmias, pulmonary edema.	-Remove from exposure. -Decontaminate. -Eye, skin irrigation. -Support ventilation and circulation. -Consult ER and SOPs.
FLAMMABLE GASES (e.g. Methane, Acetylene)	Mucous membrane irritants. Simple asphyxiants: hypoxia lightheadedness dizziness, etc.	-Remove from exposure. -Decontaminate. -O_2 if hypoxic. -Support ventilation and circulation. -Consult ER and SOPs.
OXIDIZERS (e.g. Inorganic Peroxides, Chlorine, Ammonia)	Highly irritating to eyes and mucous membranes. Lung injury.	-See Respiratory Irritants
CORROSIVES	Severe irritation to skin, mucous membranes, lungs. Shortness of breath. GI injury on ingestion.	-Remove from exposure. -Decontaminate. -Irrigation. -Support ventilation and circulation. -O_2 -Consult ER and SOPs.
RADIOACTIVE MATERIALS (e.g. Fuel rods)	Early - few if any.	-Remove from exposure. -Decontaminate -Consult ER and SOPs.


Periodic Table of Elements
Version 1.4 , 17 March 1997
Group: 18
-> Non-metals
Metals <-
Gas
Liquid
Synthesised
Solid
Metalloid
Radioactive
Transition Elements
Halogens
Noble Gases
Alkaline Earths
Alkali Metals
Lanthanides (Rare Earths)
Actinides
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CHEMICAL REFERENCE/RESPONSE ACTIVITY

For this activity you should select a chemical with which you work, or to which you have the potential of exposure, and complete the worksheet on the next page. You must use three different references.

Suggested references include: the MSDS, NIOSH pocket guide, Hawley's Condensed Chemical Dictionary, CHRIS manual, or the computer data base program TOMES. You may work in small groups of two to three or by yourself. After completing the worksheet, provide answers to the following:

QUESTIONS

1. Describe any deviations in the information from the different references cited.

2. How does this chemical threaten your health and/or safety?

3. If a release of this chemical occurs in your facility:

   a. Where would it occur?

   b. What would it do?

   c. Where would it go?

4. Describe how you would respond to this release.

5. Identify the procedures you would follow for your response if only five to six people were available to respond.

   Would your response procedure change if 10 to 12 people were available?_____
   If you answered yes, how?

6. What resources would you need to safely respond in both situations described in number 5 above?

7. What level of protection would be needed for personnel in DECON if you had only five to six people responding?

   Would levels of protection change with the availability of additional personnel?_____
   If you answered yes, how?

CHEMICAL REFERENCE/RESPONSE ACTIVITY WORKSHEET

NAME OF CHEMICAL _____

PROPERTIES	Name of Ref.	Name of Ref.	Name of Ref.
Vapor Density			
Boiling Point			
Vapor Pressure			
Flash Point			
LEL/LFL			
UEL/UFL			
PEL/TLV			
IDLH			
Ignition Temp.			
Specific Gravity			
Health Hazards			

EMERGENCY RESPONSE GUIDEBOOK

1. A tank truck with an I.D. number of 1203 is involved in an accident. What is the probable type of material? Why?

2. For I.D. number 1203 what is the chief hazard of this material?

   How do you know?

3. What is the guide number for dynamite?

4. What is the correct fire suppression procedure for a large fire involving sodium?

5. Which guide should you use for a placard showing corrosive with number 8?

6. What is the initial isolation distance for a spill or leak of 1182?

7. Why is anhydrous ammonia **high-lighted** is the blue pages of the book?

RESPIRATOR PROTECTION FACTORS

Respirator Type	Facepiece Pressure	Protection Factor
I. AIR-PURIFYING		
A. **Particulate Removing**		
Single-Use Dust	–	5
Quarter-Mask Dust	–	5
Half-Mask Dust	–	10
Half or Quarter-Mask Fume	–	10
Half or Quarter-Mask High Efficiency	–	10
Full Facepiece High Efficiency	–	50
Powered High Efficiency All Enclosures	+	1,000
Powered Dust or Fume All Enclosures	+	X
B. **Gas and Vapor Removing**		
Half Mask	–	10
Full Facepiece	–	50
II. ATMOSPHERE SUPPLYING		
A. **Supplied Air**		
Demand Half Mask	–	10
Demand Full Facepiece	–	50
Hose Mask Without Blower Full Facepiece	–	50
Pressure Demand Half Mask	+	1,000
Pressure Demand Full Facepiece	+	2,000
Hose Mask With Blower Full Facepiece	–	50
Continuous Flow Half Mask	+	1,000
Continuous Flow Full Facepiece	+	2,000
Continuous Flow Hood Helmet or Suit	+	2,000
B. **Self Contained Breathing Apparatus**		
Open Circuit Demand Full Facepiece	–	50
Open Circuit Pressure Demand Full Facepiece	+	10,000
Closed Circuit Oxygen Tank-Full Facepiece	–	50

III. COMBINATION RESPIRATOR

A. **Any Combination of Air Purifying and Atmosphere Supplying Respirator**
Use Minimum Protection Factor Listed Above for Type and Mode of Operation.

B. **Any Combination of Supplied Air**
Use Minimum Protection Factor Listed Above for Type and Mode of Operation.

QUIZ: AIR-PURIFYING RESPIRATORS

Circle **T** for a **True** statement and **F** for a **False** statement.

1. T F Carbon dioxide passes into the bloodstream in the lungs.
2. T F The two main respiratory hazards are oxygen deficiency and contamination.
3. T F Oxygen deficiency is a special danger in confined space.
4. T F To choose the right kind of respirator you must know what type of hazard is present.
5. T F Air-purifying respirators give protection against both oxygen deficiency and contamination.
6. T F Any chemical cartridge will guard against any contaminant in the air.
7. T F Gas masks are a kind of air-line respirator.
8. T F Air-line respirators protect against both oxygen deficiency and contamination.
9. T F Positive pressure inside a facepiece insures that any leaks will be from the inside outward.
10. T F Continuous-flow air-line units give the most complete protection of any respirator.
11. T F Self-contained breathing apparatuses can be used in either oxygen-deficient or contaminated atmospheres.
12. T F Self-contained breathing apparatuses for emergency response are usually stored outside the danger area.
13. T F You can always get any respirator to fit if you try hard enough.
14. T F Beards and glasses can interfere with a proper facepiece seal.
15. T F The negative- and positive-pressure fit tests should be done before entering a hazardous atmosphere.

16. T F Respirators for emergency use should be inspected once a year.
17. T F Holes in filters, torn hoses, and a cracked facepiece are just some of the things you should check for when inspecting a respirator.
18. T F It is the supervisor's responsibility to inspect all respirators used by his/her crew.
19. T F Respirators should be cleaned in pure cold water.
20. T F Respirators should be stored in the warmest place possible.

LISTING:

Identify five specific situations in which air-purifying respirators **CANNOT** be used.

1._____

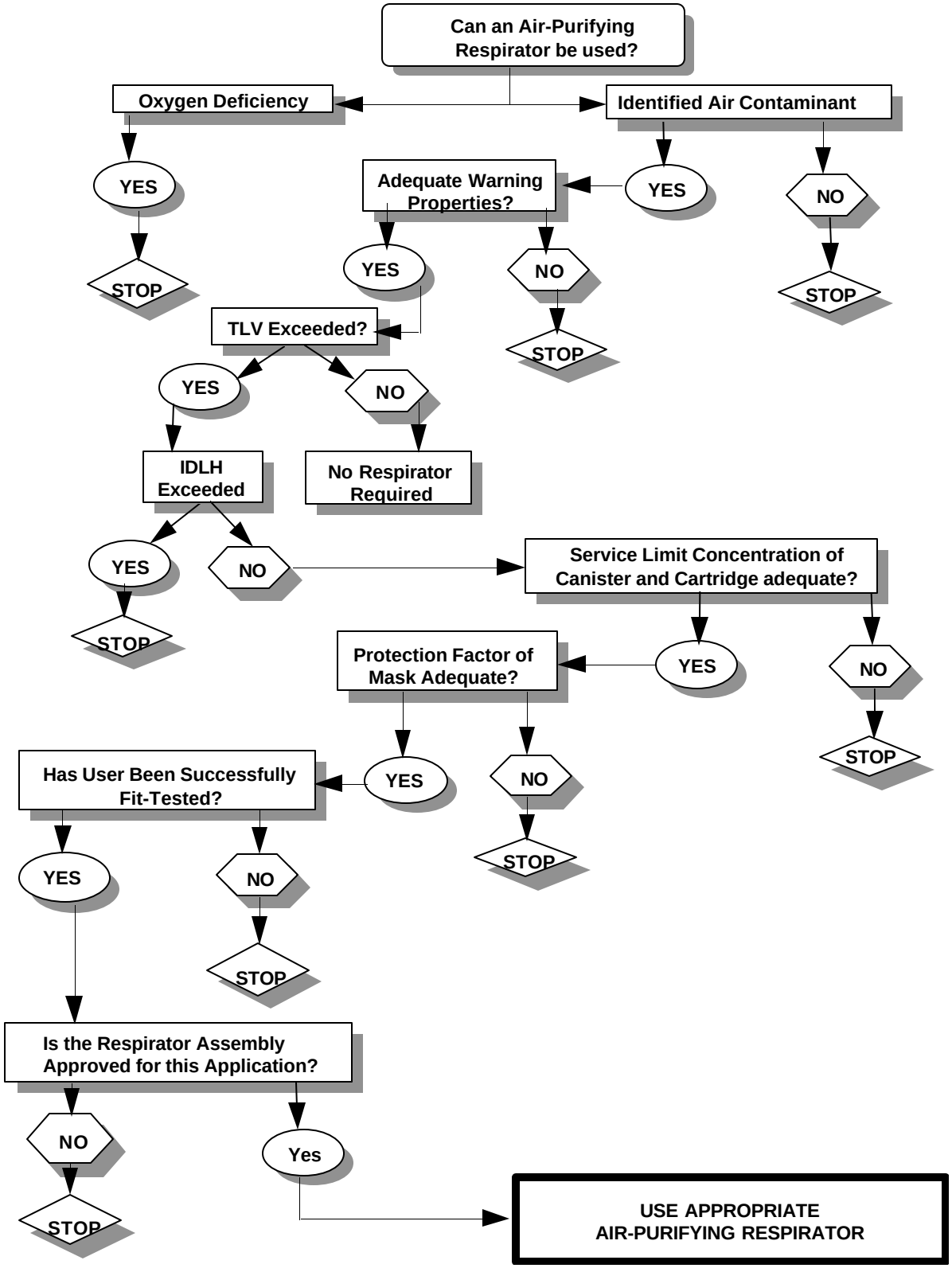
2._____

3._____

4._____

5._____

AIR RESPIRATOR FLOW CHART



PERSONAL PROTECTIVE EQUIPMENT TRAINING SCENARIOS

SCENARIO #1

Your crew has been called upon to remove soil contaminated with PCBs. One question you need to ask is: Is this PCB contaminated oil of pure PCB? What other questions need to asked?

Explain how you would assess and approach this situation.

List the resources needed to complete the task.

Identify the appropriate PPE to be used.

How would decontamination be handled?

SCENARIO #2

Your crew has been asked to move 25 drums conatianing waste perchloroethylene from a staging area to a permitted RCRA facility storage building. All the drums have been sealed, overpacked, marked, labeled, and wiped down to prevent any possibility of contamination.

Describe PPE and procedures to follow.

SCENARIO #3

A tank car has turned over during a derailing accident. The rank car contains 3,000 gallons of hydrochloric acid. 50 gallons is estimated to have been lost and your team is required to go in and plug the hole so that further release is prevented.

Describe the hazard-risk identification and assessment that should be done prior to sending in the entry team.

List the appropriate PPE that should be used.

Describe the type of decontamination procedures that would be needed.

AMMONIUM HYDROXIDE SPILL

A chemical spill has been reported in the valve room area of Building 55. Apparently a bottle of ammonium hydroxide has been spilled. The vapors have driven the work crew out of the building.

Describe your procedures for responding and the PPE to be used.

Describe your procedures if the release was anhydrous ammonia and how PPE utilization might differ.

Materials needed

___ MSDS Ammonium Hydroxide
___ NIOSH Pocket Guide to Chemical Hazards

___ SCBA
___ Full face respirator with ammonia cartridge (green)
___ Boots, over the sock or overboots
___ Gloves, nitrile, 18 inch
___ Hard hat
___ Chemrel Max coveralls
___ Radios

___ Gas sampling pump
___ Ammonia tubes, 30 to 300 PPM
___ Gas Tech Triple Range Monitor
___ pH paper
    ___ White absorbent roll
    ___ Eight foot mini dike
    ___ Citric acid neutralizer solution
    ___ Squeegee
    ___ Broom, floor
    ___ Shovel, scoop
    ___ Waste pail, 5 gallon
    ___ Mop Bucket and wringer
    ___ Mop

    ___ Decon tarp
    ___ Decon pans, brush, hose
    ___ Decon solution, soap and water
    ___ Garden hose and nozzle
    ___ Towels, red and paper

    ___ First aid kit
    ___ Eye Wash Station

BASIC CHEMISTRY
CASE STUDY

An electroplating company is preparing to switch from a cyanide process to an acid plating process. Night shift employees are cleaning the open-top steel tanks that hold the cyanide plating chemicals. A holding tank for zinc cyanide has been pumped, but about two inches of zinc cyanide, $Zn(CN)_2$, sludge remains on the bottom and must be cleaned out manually. In a cleaning procedure that has not been attempted before, an employee pumps between 1 and 2 gallons of 1% muriatic acid (dilute hydrochloric acid, HCl) solution from a 55-gallon drum into the holding tank, then climbs inside. He is wearing gloves, boots and an apron. Within a few minutes two co-workers notice the employee struggling to climb out of the tank and attempt to rescue him.

Doing reference work, describe a possible outcome for this situation.

QUESTIONS

1. What information do references provide regarding zinc cyanide that would be helpful in a similar incident if the contents of the tank were known?

2. Why did the worker inside the tank react the he did?

3. Describe an appropriate response scenario.

PROPERTIES OF HAZARDOUS MATERIALS

In response to reports of an ammonia odor, maintenance personnel in a cold storage warehouse attempt to repair a leaking valve in one room of the building's refrigeration system. Anhydrous ammonia is used as the refrigerant, and the room is normally kept at 12°F. At the time repair work begins, the temperature in the room is about 50°F. although the faulty section of the refrigeration unit is shut down, the concentration of ammonia increases, causing discomfort and irritation to the workers who are wearing only filter masks. The fire department is contacted. First arriving Fire Fighters correctly identify the situation as a hazardous materials incident and request assistance from the Hazardous Materials Response Team. While waiting for the Haz-Mat Team to arrive, Fire Fighters attempt to disperse the ammonia with a water fog. Warehouse employees inform emergency responders that the leak has been isolated and that only residual gas remains in the room. Wearing fully encapsulating, vapor-protective suits, two members of the Haz-Mat Team enter the room in order to replace the leaking valve.

A spark from a forklift used in the repair process touches off a sudden explosion. The force of the blast raises the building's roof about one foot and severely damages interior walls. Although combustible products in the vicinity of the leak were removed, other combustibles in adjacent areas of the building catch fire. The Two Haz-Mat Team members are severely burned when their protective clothing ignites. One Team Member dies within 36 hours; the other is admitted to the hospital in critical condition.

QUESTIONS

1. What hazards are presented by anhydrous ammonia?

2. Given that anhydrous ammonia presents a relatively low fire hazard how could an explosion occur?

3. What effect did the increasing temperature in the room with the leaking valve have on the incident?

MYSTERY DRUM CONTAINMENT EXERCISE

BACKGROUND

You are a member of an industrial emergency response team (ERT) at a local manufacturing plant. Your company has sent you to visit a large manufacturing plant in a neighboring city so you can learn some of their techniques and adopt some of their ideas and procedures to your own facility.

The team is equipped with the following items:

Six Level B CPCs with 30 minute SCBAs.

Spill containment materials including 50 pound bags of diatomaceous earth absorbent, plastic lining, 200 feet of plastic flotation boom, and 10 polyethylene overpacks.

Each team member has a portable radio.

A response truck that carries all the equipment and where the incident commander maintains a radio link with team members and local emergency response services.

The members are trained as operations level workers and have not received emergency response technician training.

Two emergency medical technician (EMT) personnel are onsite and routinely accompany the emergency response team (ERT) but no ambulance is on site.

PROBLEM

Shortly after you arrive the ERT receives a call to respond to a spill at their loading dock at warehouse #12. While unloading 55 gallon drums of toluene the dock crew moved 3 polyethylene drums in the tractor trailer. During the move one of these drums was dropped six feet onto a drum of toluene near the loading dock. Both drums were damaged and are leaking. The loading dock crew complained of strong vapors and headaches. The team is told to treat this situation as a serious emergency and to don Level B suits with SCBAs before entering and working in the area. All personnel have been evacuated from the immediate area.

FIGURE 1 FOR VISUAL OF SPILL AT THE LOADING DOCK.

QUESTION A

The Incident Commander invites you to come along and observe. You accompany the team to the warehouse and find the situation as describe.

The ERT quickly establishes that one damaged drum contains toluene but that no one present knows the contents of the second drum that was dropped. The contents of this drum are leaking and mixing with the toluene. No reaction is visible. The puddle from the two drums is slowly moving toward a storm sewer drain.

If you were the incident commander what would you do? Circle what you feel is the appropriate response.

1. Make sure the area is evacuated, establish the perimeter and zones, get the crew suited up, and immediately contain the spill using defensive actions before the material reaches the storm sewer.
2. Make sure the area is evacuated, keep people away, obtain information to identify the unknown material and its hazard potential, and keep the ERT out of the area until you know what you are dealing with.

QUESTION B

The Incident Commander decides to contain the spill. He and his team set up the hot zone and the decon line (See Figure 2). The Incident Commander tells Joe and Boris to get their Level B PPE on and go in and contain the spill before it reaches the storm sewer. He tells Natasha and Abe to don their Level B PPE and to standby as backups. Just as Joe completes suiting-up his elbow pokes through a small rip in the left sleeve of his suit. You see him sticking two of his right glove fingers into the hole. His partner, Boris says, "I'm ready. Let's go!" The Commander asks Joe if he is ready.

What should Joe do? Circle the best response of those provided.

1. Ask for some duct tape to seal the rip in his sleeve.
2. Tell the Commander to wait while he changes into a new suit.
3. Ask for an oversleeve to cover the rip in his sleeve.
4. Tell the Commander he is ready and get on with the work.
5. Tell the Commander about the rip and ask to be replaced by a backup.

FIGURE 2: Boris and Joe about to enter the hot zone

QUESTION C

The Incident Commander chooses Abe to replace Joe. Meanwhile, Joe goes to don an extra suit and join Natasha as a Level B backup. The Commander tells Abe and Boris to enter the hot zone to contain the spill. They take their materials in the wheelbarrow and soon arrive near the loading dock (See Figure 3).

What should Abe and Boris do now? Prioritize the given responses as to what you would do first, second, third...etc.

_____ Make a quick visual inspection of the area to make sure it is safe to begin working.
_____ Place a length of the flotation boom around the spill.
_____ Upright the drums, plug the leaks, and overpack the drums.
_____ Immediately go into the truck trailer and check for additional unmarked drums.
_____ Close off the storm sewer by lifting the grate, placing a sheet of plastic across the drain, and then replacing the grate.
_____ Dam around the storm sewer drain with absorbent.
_____ Use the absorbent to build a containment berm around the spill.

FIGURE 3: Abe and Boris working in the hot zone

QUESTION D

In about 15 minutes Abe and Boris have plugged the storm sewer drain and nearly completed containing the spill. Suddenly a large white vapor cloud begins to rise above the liquids leaking from the drums (See Figure 4).

What should Abe and Boris do now? Again prioritize your responses from those provided.

_____ Since they are almost done finish containing the spill.
_____ Call the Incident Commander and ask for equipment so they can sample the contents of the unknown drum.
_____ Immediately leave the area and notify the Incident Commander.
_____ Abe should complete the containment berm while Boris goes to the CRC to get some monitoring equipment.
_____ Move closer to the vapor and feel the liquid and the drums to see if they are hot.

FIGURE 4: A large vapor cloud forms

QUESTION E

Abe and Boris rapidly move to the decon contamination reduction corridor. Just before they enter the contamination reduction zone the low pressure alarm on Boris' SCBA activates. Boris starts to throw his arms around and yells, "Get me out of here! I can't breathe!"

What should Abe do? Prioritize your responses as before.

_____ Ask the Incident Commander what to do.
_____ Try to calm Boris and then ask him what is wrong.
_____ Check Boris' SCBA air gauge.
_____ Tell Boris to shut-up and quit fooling around.
_____ Make a quick visual inspection to see if Boris' SCBA is working.
_____ Inform the Incident Commander of what has happened.

QUESTION F

Even though Boris' low pressure alarm is still ringing Abe has managed to calm him down. Over the radio you hear Boris say, "I can't get enough air and I feel dizzy." and his breathing sounds very rapid and labored.

What should Abe and the others do now to help Boris? Prioritize the responses provided.

_____ Tell Boris to go immediately to the air-bottle change station and get a full bottle.
_____ Tell Boris to take his SCBA face-piece off while he proceeds through decon.
_____ Tell Boris to keep his face-piece on but disconnect his air line from the regulator and breathe through the air line while he proceeds with decontamination.
_____ Tell Boris to breathe slowly, activate his emergency by-pass valve, and keep his SCBA face-piece on until he completes decontamination.
_____ Make sure someone has called an ambulance for Boris so he can receive prompt medical assistance.
_____ Make sure Boris is decontaminated first ahead of Abe.
_____ Request that the Incident Commander send the medical team to the decon area so they may check Boris as soon as decon is complete.

QUESTION G

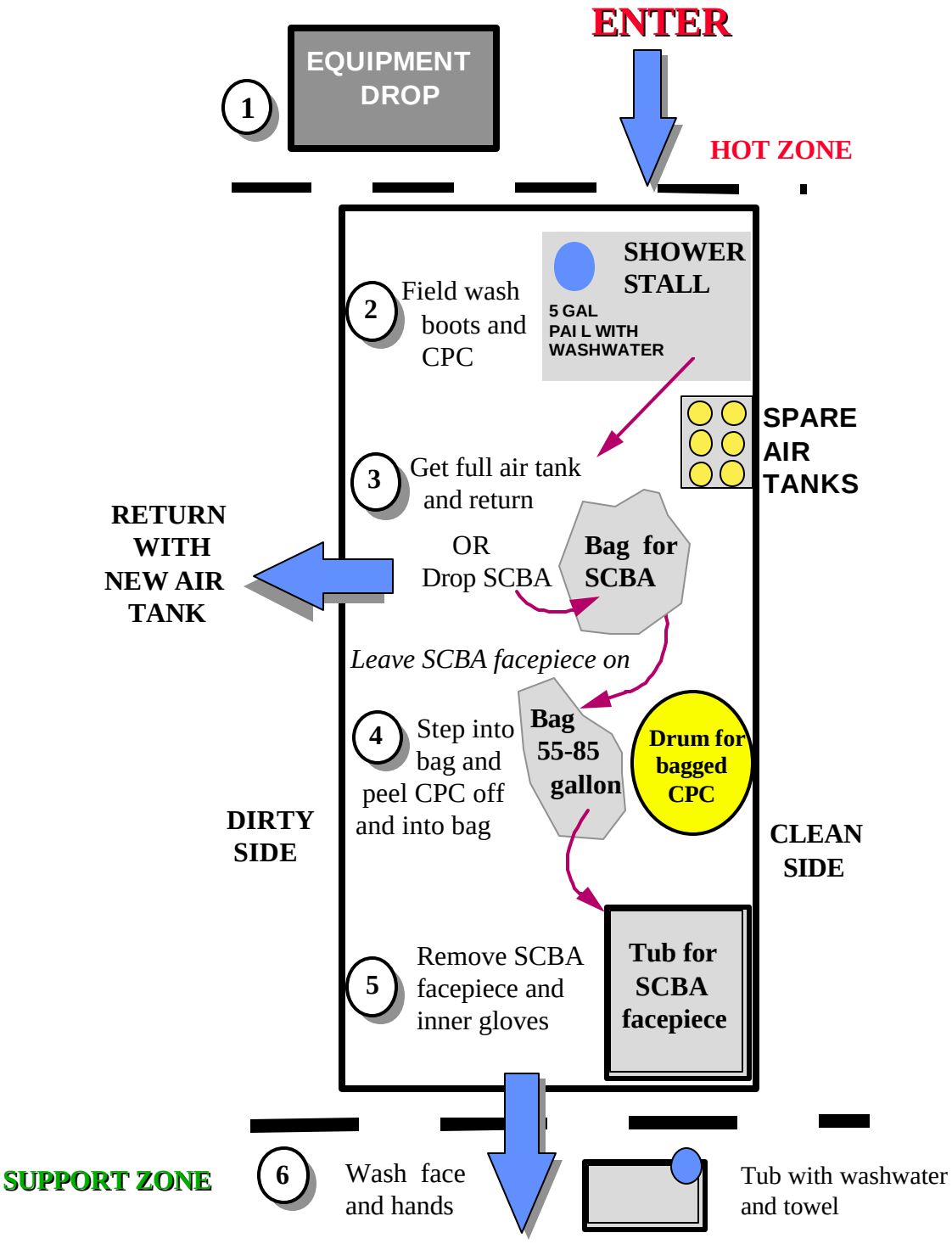
The unknown chemical was later determined to be hydrogen peroxide. The reaction produced a vapor cloud of toluene and water vapor.

Boris' regulator low pressure alarm was found to be defective. He had more than ten minutes of air when his alarm went off. He was OK as soon as he opened the emergency by-pass valve and was decontaminated with no further problems.

Think about the whole exercise. What could have been done to prevent the problems encountered by the ERT and/or potential problems that might have been encountered? Circle all responses that would be MOST appropriate.

1. PPE should be regularly inspected and inspected before dress-out.
2. As soon as they dropped the drum the loading dock crew should have immediately contained the spill.
3. The truck load should have been inspected prior to unloading.
4. The crew unloading the truck should not have moved the polyethylene drums.
5. Information about the contents of the drums and their potential reactions should have been gathered before and during the incident.
6. If there had been ERT technicians present, once the vapor cloud developed, these persons could have sampled and identified the unknown materials.
7. Until the unknown material was identified, the ERT should not have entered the area unless there was a need to rescue a living victim.
8. The two workers in the decontamination line should have been in Level B PPE.

DECON PROCEDURES:
(Flow Chart)



INCIDENT COMMAND CHECK LIST

TEN STEPS TO A SAFE RESPONSE

___ 1. GET INFORMATION ON WHAT HAS BEEN RELEASED AND HOW
___ 2. REQUEST ASSISTANCE
___ 3. SEAL OFF THE AREA
___ 4. CHECK FOR INJURIES
___ 5. IDENTIFY THE HAZARDS
___ 6. PREPARE A PLAN OF ACTION
___ 7. OBTAIN EQUIPMENT AND MATERIALS
___ 8. CONTAIN AND CONTROL THE RELEASE
___ 9 CLEAN UP THE MATERIAL
___ 10 DECONTAMINATE PERSONNEL AND EQUIPMENT

PROPER PROCEDURES FOR HANDLING AN EMERGENCY RESPONSE TO A HAZARDOUS MATERIALS RELEASE

1. Use the Incident Command System.
2. Identify, classify and verify the identity of materials involved.
3. Use knowledge of basic chemical and toxicological information and behavior in developing control strategy; implementing control, containment and confinement operations; decontaminating personnel and equipment; and terminating a hazardous materials incident.
4. Use field survey instruments to asses contaminant levels,
5. Use hazard and risk assessment techniques when developing strategy and setting priorities.
6. Select and properly use available chemical protective equipment .
7. Select and use control, containment and confinement techniques to bring the release of a hazardous material under control.
8. Use appropriate decontamination procedures based on the type and level of contamination.
9. Properly terminate the incident assuring safety of the area, proper documentation of actions and the proper recording of any exposures.

General Site Control

___ SITE CONTROL
- ___ Access to facility controlled
- ___ Access to building controlled by _____
- ___ Access to roadways and ramps blocked by _____, at _____ am/pm

___ HAZARD AREA ISOLATED
- ___ Room evacuated
- ___ Floor evacuated
- ___ Floor above evacuated at _____ am/pm by_____
- ___ Floor below evacuated at _____ am/pm by_____
- ___ Entire building evacuated at _____ am/pm by_____

___ HAZARD ZONES ESTABLISHED
- ___ Hazard Zone (hot or exclusion)
- ___ Contamination Reduction Area (warm or transition)
- ___ Support Area(s) (cold)
- ___ All sectors advised of zone locations

___ BUILDING HVAC SYSTEM
- ___ In operation
- ___ Shut down
- ___ Out of service

EVALUATE HAZARDS AND RISKS

___ HAZARDOUS MATERIALS DATA SHEET COMPLETED

___ INTEGRITY OF INVOLVED CONTAINERS CHECKED
- ___ Stress (thermal, mechanical, chemical)
- ___ Breach (split, puncture, cracking, disintegration, attachments)
- ___ Release (spill, leak, rapid release, violent, detonation)
- ___ Engulfing (cloud, plume, stream)
- ___ Impinging (short term, medium term, long term)
- ___ Harm (thermal, corrosive, mechanical, toxic, radiation)

___ HAZARDS EVALUATED
- ___ Health, NFPA ____
- ___ Flammability, NFPA ____
- ___ Reactivity, NFPA ____
- ___ Physical Properties, _____

___ LIKELY HARM WITHOUT INTERVENTION ESTIMATED

___ DECONTAMINATION NEEDS DETERMINED

___ ADDITIONAL EVACUATION NEEDED

___ OTHER _____

CHOOSE PROTECTIVE CLOTHING AND EQUIPMENT

___ PROTECTIVE CLOTHING RECOMMENDATION
- ____ Level A
- ____ Level B with oversuit
- ____ Level B limited use
- ____ Level B rainsuit
- ____ Level C
- ____ Level D

___ DECONTAMINATION AREA ESTABLISHED _____ am/pm
___ SUPPORT AREA ESTABLISHED _____ am/pm
___ COMMUNICATIONS ESTABLISHED and checked _____ am/pm

COORDINATE INFORMATION I

___ FIRST ENTRY (RECON) TEAM READY at _____ am/pm
- ____ Proper protective equipment
- ____ Buddy system in place
- ____ Back-up team in place
- ____ Decontamination ready
- ____ Support ready

___ PERMISSION GRANTED to send in first entry team at _____ am/pm
- ____ Hazard, Safety, Decon Advised

___ MONITOR RECON TEAM COMMUNICATIONS
___ AREA CHECKED FOR INJURED INDIVIDUALS
___ HAZARDS ARE IDENTIFIED AND VERIFIED
___ RECON TEAM OUT AT _____ am/pm
___ RECON TEAM DEBRIEFED AT _____ am/pm
___ TACTICAL OPTIONS REVIEWED AND DISCUSSED

1. _____
   _____
   _____
2. _____
   _____
   _____
3. _____
   _____

___ PROTECTIVE CLOTHING RECOMMENDATION "OK" BASED ON RECON
___ DECON "OK" BASED ON RECON DATA
___ SUPPORT "OK" BASED ON RECON DATA

COORDINATE INFORMATION II

___ SECOND ENTRY TEAM READY AT_____ am/pm
- ____ Proper protective equipment
- ____ Buddy system in place
- ____ Back-up team in place
- ____ Decontamination ready
- ____ Support ready

___ PERMISSION GRANTED to send in second entry team at _____ am/pm
- ____ Hazard, Safety, Decon Advised

___ MONITOR TEAM COMMUNICATIONS

___ SECOND TEAM OUT AT _____ am/pm

___ SECOND TEAM DEBRIEFED AT_____ am/pm

___ TACTICAL OPTIONS REVIEWED AND DISCUSSED

1. _____
   _____
   _____
2. _____
   _____
   _____
3. _____
   _____

___ PROTECTIVE CLOTHING RECOMMENDATION "OK"

___ DECON "OK"

___ SUPPORT "OK"

___ NOTES:

COORDINATE INFORMATION III

___ THIRD ENTRY TEAM READY AT _____ am/pm
- ____ Proper protective equipment
- ____ Buddy system in place
- ____ Back-up team in place
- ____ Decontamination ready
- ____ Support ready

___ PERMISSION GRANTED to send in third entry team at _____ am/pm
- ____ Hazard, Safety, Decon Advised

___ MONITOR TEAM COMMUNICATIONS

___ THIRD TEAM OUT AT _____ am/pm

___ THIRD TEAM DEBRIEFED AT _____ am/pm

___ TACTICAL OPTIONS REVIEWED AND DISCUSSED

1. _____
   _____
2. _____
   _____
3. _____
   _____

___ PROTECTIVE CLOTHING RECOMMENDATION "OK"

___ DECON "OK"

___ SUPPORT "OK"

___ NOTES:

COORDINATE INFORMATION IV

___ ___ ENTRY TEAM READY AT _____ am/pm
- _____ Proper protective equipment
- _____ Buddy system in place
- _____ Back-up team in place
- _____ Decontamination ready
- _____ Support ready

___ PERMISSION GRANTED to send in ___ entry team at _____ am/pm
- _____ Hazard, Safety, Decon Advised

___ MONITOR TEAM COMMUNICATIONS

___ ___ TEAM OUT AT _____ am/pm

___ ___ TEAM DEBRIEFED AT _____ am/pm

___ TACTICAL OPTIONS REVIEWED AND DISCUSSED

1. _____
   _____
   _____
2. _____
   _____
   _____
3. _____
   _____
   _____

___ PROTECTIVE CLOTHING RECOMMENDATION "OK"

___ DECON "OK"

___ SUPPORT "OK"

___ NOTES:

SCOTT®

SCOTT-ALERT CORRELATION DATA
INSTRUMENT CALIBRATED FOR HEXANE

The actual % of the gas/vapor concentration present is equal to the instrument indication X the factor listed.

Example: Diethyl ether - instrument indicates 60%
60% X 0.95 = 57% of the LEL or LFL of diethyl ether.

Caution: Correlation data is accurate to within ±10% full scale

GAS OR VAPOR	FACTOR	GAS OR VAPOR	FACTOR
ACETALDEHYDE	0.52	HEXENE	0.58
ACETONE	0.86	HYDROGEN	0.39
		(> 39% LEL is off the scale)	
ACETYLENE	0.56	ISOPROPYL ALCOHOL	0.73
AMMONIA	0.52	METHYL ETHYL KETONE	0.90
BENZENE	0.86	METHYL ISOBUTYL KETONE	0.95
1,3-BUTADIENE	0.56	METHANE	0.38
		(>38% LEL is off the scale)	
N-BUTANE	0.66	METHANOL	0.58
ISO-BUTANE	0.68	MINERAL SPIRITS	1.58
ISO-BUTYLENE	0.70	NAPTHA, V.M.&P.	1.19
N-BUTYL ALCOHOL	1.06	N-OCTANE	1.46
CYCLOHEXANE	0.95	OCTENE	1.36
CYCLOHEXANONE	1.19	PENTENE	0.86
DIMETHYL FORMAMIDE	0.86	ISO-PENTANE	0.86
DIETHYL ETHER	0.95	ISOPRENE	0.58
N-DECANE	1.46	PROPANE	0.56
ETHANE	0.52	PROPYLENE	0.63
ETHYL ACETATE	0.90	STYRENE	1.27
ETHYL ALCOHOL	0.63	TETRAHYDROFURAN	0.53
ETHYL BENZENE	1.06	TOLUENE	1.00
ETHYLENE	0.53	VINYL ACETATE	.70
ETHYLENE OXIDE	0.61	VINYL CHLORIDE	1.06
HEPTANE	1.00	O-XYLENE	1.36
N-HEXANE	1.00		

NOTE: The use of correlation data has not been approved by FM on the FM approved instruments.

COMBUSTIBLE GAS INDICATOR EXERCISE

COLORMETRIC TUBES:
BENZENE QUIZ DATA SHEET

GASTEC

BENZENE DETECTOR TUBE NO. 121

The Gastec Detector Tube no. 121 provides a rapid, full quantitative analysis of the concentration of BENZENE in air with a minimum accuracy of ± 25% at 1, 2 and 5 times TLV or ± 35% at 1/2 TLV utilizing the Gastec Multi-Stroke Gas Sampling Pump.

Performance:

Calibration Scale	10 - 60 ppm (based on 2 pump strokes)		
Color Change	White - Brownish Green		
Shelf Life	3 years		
Measuring Range	5 - 30 ppm	10 - 60 ppm	60 - 120ppm
Number of Pump Strokes	4	2	1
Sampling Time	2.5 minutes per pump stroke		

MEASUREMENT PROCEDURE:

1. Break tips off a fresh detector tube by bending each tube end in the tube tip breaker of the pump.
2. Insert the tube securely into the rubber inlet of the pump with the arrow on the tube pointing toward the pump.
3. Make certain the pump handle is all the way in. Align the red dots on the shaft and housing of the pump.
4. Pull the handle all the way out until it locks on 1 pump stroke (100 ml). Wait until staining stops. Repeat this sampling procedure one more time without removing the tube. For consecutive stroke sampling, the handle must be turned 1/4 turn in either direction to unlock the pump so the handle can be returned to the starting position.
5. Read concentration at the interface of the stained-to-unstained reagent when staining stops after completion of 2 stroke (200 ml) sampling.
6. For more accurate measurement at less than 30 ppm, use 4 pump strokes (400 ml). Obtain true concentration by dividing the tube reading by 2 (see table below).
7. If the stain exceeds the highest calibration mark (60 ppm) with 2 pump strokes (200 ml), use 1 pump stroke (100 ml). Obtain true concentration by doubling the tube reading.

Benzene C_6H_6

Tube Reading (ppm)	10	20	30	40	50	60
4 pump strokes (400 ml)	5	10	15	20	25	30
2 pump strokes (200 ml)	10	20	30	40	50	60
1 pump stroke (100 ml)	-	-	60	80	100	120

CORRECTION FOR TEMPERATURE, HUMIDITY OR PRESSURE:

Calibration of the Gastec detector tube No. 121 is based on a tube temperature of 20°C (68° F) and not the temperature of the gas being sampled, approximately 50% relative humidity, and normal atmospheric pressure. No correction is needed for tube temperatures of 0° - 40°C (32° -104°F) and for relative humidity range of 10 - 90%. At high humidity range, color stain is decolorized at the gas inlet by 2 - 3 mm, however, tube provides an accurate indication. To correct for pressure multiply tube reading by :

$$\frac{760}{\text{Atmospheric Pressure (mm Hg)}}$$

CALIBRATION AND ACCURACY;

The Gastec detector tube No. 121 is carefully calibrated as an integral part of the manufacturing process. Calibration and accuracy test are performed using combinations of dynamic diffusion tube method, or standard reference gas of known concentration and dynamic gas flow system, and gas chromatographic technique or gravimetric analysis after impregnation in charcoal sampling tube.

DETECTION PRINCIPLE:

Benzene reduces iodine pentoxide to liberate iodine, which is brownish green in color

$$C_6H_6 + I_2O_5 = H_2SO_4 \rightarrow I_2$$

INTERFERENCES:

Interferent	**Concentration**	**Result**	**Comment**
Toluene	More than 10 ppm	Plus error but no effect at more than 25 ppm benzene	Also produces similar stain at 5ppm
Xylene	More than 20 ppm		Also produces similar stain at 20 ppm
Alchols & Ketones	More than 0.5%	Plus error	Also produces similar stain at 50 ppm
Esters	More than 0.2%	Plus error	No stain by themselves

Vinyl chloride		
Hexane, Ethylene & Acetylene	No effect on reading	Discolor slightly entire reagent to pale brown at a few %

Tube produces two separate color stains (the upper by benzene only, the lower by benzene interferent)

DANGEROUS AND HAZARDOUS PROPERTIES:

Threshold Limit Value-Time Weighted Average by ACGIG(1979): 10 ppm (7-8 hours)

Flammable Limit: 1.4% - 7.1%

APPLICATION FOR OTHER GASES:

The Gastec detector tube No. 121 can also be used to detect CHLOROBENZENE or o-DICHLOROBENZENE in air. Obtain concentration of these chemical substances from the following tables:

1. Chorobenzene C_6H_5Cl (TLV: 75ppm) Color Change: White - Greenish Brown

Tube Reading (Benzene ppm)	10	20	30	40	50	60
2 pump strokes (200 cc)	5	15	30	40	60	80
1 pump stroke (100 cc)	20	50	100	150	250	350

2. o-Dichlorobenzene $C_6H_4Cl_2$ (TLV: 75ppm) Color Change: White Brown

Tube Reading (Benzene ppm)	10	20	30	40	50	60
2 pump strokes (200 cc)	10	50	150	300	500	700

Although No.121 tube can be used to detect Chorobenzene or o-Dichlorobenzene, such use is not currently certified by NIOSH.

SEE OPERATING INSTRUCTION INCLUDED WITH THE GASTEC MULTI-STROKE GAS SAMPLING PUMP.

Printed in Japan

QUIZ: COLOROMETRIC TUBES: BENZENE

BASED ON THE BENZENE TUBE, PUMP & INSTRUCTION SHEET:

1. How long does it take the pump to draw fully?

2. How many pump strokes will give you a direct reading?

3. What is the range of measurement of this tube?

4. What is the reaction based upon and what is the color change?

5. You suspect there might be some other hydrocarbons in the vicinity of the release. Will this effect the reading? Explain.

6. You suspect there might be some vinyl chloride in the vicinity of the release. Will this effect the reading? Explain.

7. You suspect there might be some chlorobenzene in the vicinity of the release. Will this effect the reading? Can the tube be used to identify the quantity? Explain.

8. Can this tube be reused?

9. What is the TLV?

10. What is the accuracy of this tube?

11. What atmospheric conditions effect this tube?

DRUM TRANSFER
FLAMMABLE, COMBUSTIBLE, OR TOXIC LIQUIDS

SITUATION:

A 55 gallon drum containing a flammable/toxic liquid has been stressed (damaged). The liquid can be salvaged.

ACTIVITY:

Effect a safe transfer to a receiving drum and;

1. Reduce the risk of static electrical discharge through bonding and grounding of the drums.
2. Reduce and/or eliminate release of vapors to the atmosphere while inducing an oxygen deficient environment in the damaged drum.
3. Eliminate the potential for the development of an explosive atmosphere in both drums.

HAZARDS:

1. Production of vapors sufficient to reach the LEL of the liquid in both drums and the ambient atmosphere.
2. Contamination of the ambient environment with toxic vapors.

PPE REQUIREMENTS:

Face shield, hard hat, and gloves for this training exercise. In an actual event SCBA and additional PPE may be required based upon evaluation by the safety officer.

DECON REQUIREMENTS:

Decon will not be used in this training exercise. In an actual event standard dry decon procedures may be required based upon evaluation by the safety officer.

PROCEDURE:

Following the 'Ten Steps to a Safe Response" initiate the described procedure to contain and control the potential release.

1. Use a non-ferrous (brass) wire brush to remove rust and paint from the drums to insure good bonding and grounding contact (if drums are metal).
2. Connect the bonding wire (1) to the damaged drum and then to the receiving drum (2). Connect grounding wire to the receiving drum (3) and then to the grounding rod (4) as shown in the diagram. (Do not transfer flammable or combustible liquids to non metal drums)
3. Remove both bungs from the receiving drum.
4. Carefully remove the large bung from the damaged drum and insert the transfer pump through the adapter collar.
5. Secure the transfer pump in the adapter collar by tightening the thumb screw.
6. Place the discharge nozzle of the 5# carbon dioxide fire extinguisher into the large bung opening of the receiving drum and release the carbon dioxide into the drum displacing the air in the drum.
7. Attach the threaded end of the transfer hose connector to the receiving drum large bung opening.
8. Attach one end of the vent tube to the small bung opening of the damaged drum.
9. Attach the transfer hose to the transfer pump and then connect the vent tube to the receiving drum.
10. Transfer may now begin.
11. When transfer is complete remove the transfer pump, hose, tube, attachments, and replace all bungs securely.
12. Finally, remove the grounding clamps and bonding clamps in the same order as that of attachment (1,2,3,4).
13. Follow established SOP for cleanup, disposal, and decontamination of drums and equipment.

As the liquid is moved from the damaged drum to the receiving drum, the liquid displaces the carbon dioxide which is then vented into the damaged drum. This process reduces the risk of explosion/fire by lowering the oxygen concentration within each drum and by decreasing the amount of vapors released to the ambient atmosphere.

AIRBAG DEPLOYMENT FOR A LEAKING STORAGE TANK

SITUATION:

A several hundred gallon storage tank has been damaged causing a breach in the tank wall. Hazardous material is flowing from the opening.

ACTIVITY:

Effect procedures to prevent further loss of hazardous material into the confinement dike by use of an air bag placed over the breach.

HAZARDS:

1. Release of vapors from the hazardous material to the atmosphere.
2. Contamination of the surrounding area.
3. Potential contamination of the entry Haz Mat team.
4. Potential health risk to the entry Haz Mat team.

PPE REQUIREMENTS:

Chemical splash suit, face shield, hard hat, chemical resistant boots, and chemical resistant gloves for this training exercise. In an actual event SCBA and additional PPE may be required based upon evaluation by the safety officer.

DECON REQUIREMENTS:

Decon will not be used in this training exercise. In an actual event standard dry decon procedures may be required based upon evaluation by the safety officer.

PROCEDURE:

Following the 'Ten Steps to a Safe Response" initiate the described procedure to contain and control the release.

1. Extend the one of the cinching straps around the tank and through one set of retainers on one side of the air bag. Repeat this process for the other strap. Be sure to remain clear of the leak while performing these functions. Additional straps or chains may be required depending upon the circumference of the tank.

2. Once the straps are in position, place the backing pad between the air bag and the tank to protect the air bag from possible puncture. Slide the air bag and backing pad into position over the breach in the tank. A method of marking the opening on the tank may be needed to ensure proper placement or centering of the bag over the breach.

3. Attach the air line coupling to the air bag.

4. Slowly open the air valve charging the air bag. Slowly inflate the air bag until the flow of material is stopped. Do not exceed the rated inflation pressure as stated by the manufacturer.

5. If the escape of material is not sufficiently stopped or reduced deflate the air bag and reposition. Repeat step 4.

6. Once the leak has been successfully stopped, transfer of material can now be effectively initiated.

7. When material transfer is completed remove the air bag and follow SOP for clean up and decontamination of the area and equipment.

CHEMICAL HAZARD AWARENESS QUIZ

Circle the letter of the most correct response for each of the following questions.

1. Flammable liquids with low boiling points:
   a. have vapor densities less than one.
   b. are changed into gas at very high temperatures and pressure.
   c. are usually polar.
   d. present a greater fire hazard than those with a high boiling point.

2. The flash point of a liquid or solid refers to the:
   a. temperature needed to vaporize a liquid or solid.
   b. temperature needed to liquefy a flammable solid.
   c. temperature needed for the liquid or solid to form an ignitable mixture in air.
   d. temperature needed for a liquid or solid to burn.

3. Under what circumstances can a Team Member be certain that hazards involving an acid have been effectively controlled?
   a. When the acid has been diluted by adding at least two parts of water for every part of acid.
   b. When the pH of the material has been raised to about 4.
   c. When an acid has been neutralized by a weak base.
   d. When bystanders are no longer complaining of eye and throat irritation.

4. Which statement about vapor density is true?
   a. Gases heavier than air have a vapor density of less than 1.0.
   b. Vapors are heavier than air while gases are lighter than air.
   c. Vapor density and vapor pressure refer to the same property.
   d. Gases with a vapor density less than 1.0 tend to rise in air.

5. Pesticides found in agricultural lawn and garden facilities are particularly hazardous to First Responders because:
   a. pesticides are easily absorbed through the skin.
   b. burning pesticides are hazardous until water is applied.
   c. it is impossible to determine health effects even if the identify of the chemical is known.
   d. all of the above.

6. An asphyxiant is any substance that:
   a. burns only in the presence of oxygen.
   b. is absorbed through the respiratory system.
   c. is heavier than air.
   d. deprives the body of oxygen.

7. A sensitizer is a type of toxin that:
   a. causes inflammation to the skin, eyes, or lungs.
   b. increases sensitivity to the effects of carcinogens.
   c. causes allergic reactions after repeated exposures.
   d. causes changes to the genetic material of cells.

8. Which one of the following increases the amount of toxic substance absorbed through an individual's lungs?
   a. Breathing air with a high oxygen content.
   b. Breathing very cold or very hot air.
   c. Breathing quickly and deeply.
   d. All of the above.

9. Which of the following is true regarding inhalation exposure?
   a. Most inhaled toxins go deep into the lungs where they are metabolized.
   b. Organs other than the lungs may be the targets of toxic effects of inhaled chemicals.
   c. Photo sensitization of respiratory structures may result.
   d. Respiratory rate has little impact on the amount absorbed.

10. Which of the following is true regarding exposure by ingestion?
    a. Hazardous substances that are ingested affect only organs in the gastrointestinal system.
    b. Ambient (atmospheric) temperature significantly affects the rate of absorption.
    c. Consuming food and fluids outside of contaminated areas is safe for decontaminated personnel.
    d. Ingestion is the most common route of exposure to hazardous materials for First Responders.

11. Why is assessment of the cardiovascular system an important part of a baseline medical surveillance exam?
    a. It helps determine risk factors that would not allow someone to safely use a self-contained breathing apparatus.
    b. It identifies people with cardiovascular risk factors so that they will not be permitted to use personal protective equipment.
    c. It is used to determine whether someone may safely undergo diagnostic medical testing.
    d. It determines the probability of cardiac arrest.

12. Which of the following is <u>not</u> true regarding chlorine?
    a. It is corrosive to body tissues as well as metals and other materials.
    b. It reacts violently with most organic materials.
    c. Its vapor is easily ignited.
    d. Since it exists as a vapor at room temperature and pressure it is difficult to contain if leaking from its transport carrier.

13. Which of the following is true regarding specific gravity?
    a. It indicates whether a substance will sink or float if placed in water.
    b. It refers to a materials tendency to sink or rise in air.
    c. It refers to the weight (in air) of a material at standard temperature and pressure.
    d. It indicates a material's reactive potential.

14. Gases and vapors that are heavier than air:
    a. have vapor densities less than 1.
    b. pose a hazard because they can displace air especially in low-lying areas.
    c. are usually not reactive.
    d. all of the above answers are correct.

15. A complete Material Safety Data Sheet must contain all of the following information **EXCEPT:**
    a. the name of the chemical.
    b. the quantity of the material being transported.
    c. data about the health effects of the chemical.
    d. information about the chemical's physical properties.

16. What characteristic makes liquefied petroleum (LP) particularly hazardous?
    a. They are lighter than air and therefore spread quickly.
    b. They are highly poisonous.
    c. They are heavier than air and may not easily disperse.
    d. Some of these gases emit radiation.

17. Which of the following is a route of entry for exposure to pesticides?
    a. Inhalation.
    b. Ingestion.
    c. Skin absorption.
    d. All of the above are correct.

18. Skin sensitization occurs when:
    a. repeated exposures cause an allergic reaction.
    b. exposures increase the risk of skin cancer.
    c. exposures result in death of the affected tissue.
    d. repeated exposures result in irritation from sunlight exposure.

19. Which one of the following is not true regarding the NFPA marking system for fixed site installations?
    a. If a material is an oxidizer, this is noted by "OXY" in the white section of the diamond.
    b. The health, flammability, and reactivity hazards are ranked from 0 to 4 with 0 indicating low or no risk.
    c. The four areas of information are: Flammability, health hazard, reactivity, and specific hazard.
    d. The NFPA marking system may be used in transportation in addition to the DOT placarding system for certain shipments.

20. The temperature at which a liquid changes to a gas is its:
    a. freezing point.
    b. boiling point.
    c. melting point.
    d. flash point.

21. Specific gravity
    a. of air equals 1.
    b. of water equals 1.
    c. indicates the reactivity of a substance.
    d. of solids is always greater than that of liquids.

22. Substances that occur naturally as gases:
    a. have low boiling points compared with solids and liquids.
    b. usually form a solid if cooled to boiling point.
    c. are not affected by changes in pressure.
    d. cannot be changed into solid form.

23. A self-contained breathing apparatus should be used:
    a. when entering any environment with unknown airborne contaminants.
    b. only when the level of airborne contaminant is above regulatory standards.
    c. only when materials are burning.
    d. unless it will hamper rescue efforts.